Refine Search

Your wildcard search against 10000 terms has yielded the results below.

Your result set for the last L# is incomplete.

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Search Results -

Terms	Documents
L14 and ((gross$ or sum$ or total$) with fault$ with compar$)	9

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L15

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Monday, June 19, 2006 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
L15	L14 and ((gross$ or sum$ or total$) with fault$ with compar$)	9	L15
L14	L10 or l11 or l12	670	L14
L13	(4827411 | 4896319 | 5559955 | 4858152 | 5274572 | 5802286 | 5038318 | 4251858 | 5133063 | 4701845 | 4833592 | 4956835 | 5109486 | 5606664 | 4695946 | 5138712 | 5036334 | 5049873 | 5226120 | 4694946 | 4821220 | 5008853 | 5276789 | 4545011)![PN]	48	L13
	DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR		
L12	(4827411 | 4896319 | 5559955 | 4858152 | 5274572 | 5802286 | 5038318 | 4251858 | 5133063 | 4701845 | 4833592 | 4956835 | 5109486 | 5606664 | 4695946 | 5138712 | 5036334 | 5049873 | 5226120 | 4694946 | 4821220 |	24	L12

5008853 | 5276789 | 4545011)![PN]

DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR

L11	('6049828'| '5812750'| '5751933'| '5261044'| '5436909'| '5295244'| '5559955'| '6374293'| '5504921')[ABPN1,NRPN,PN,TBAN,WKU]	11	L11
L10	('6049828'| '5812750'| '5751933'| '5261044'| '5436909'| '5295244'| '5559955'| '6374293'| '5504921')[URPN]	638	L10
L9	L7	9	L9
L8	L7 and catalog$	0	L8
L7	L4 and database$	9	L7
L6	L4 and catalog$	0	L6
L5	L4 and catalog$ and database$	0	L5
L4	l2 or L3	9	L4
L3	L1 and @pd<=19981019	7	L3
L2	L1 and @ad<=19981019	9	L2
L1	((gross$ or sum$ or total$) with fault$ with compar$) and internet$ and order$	20	L1

END OF SEARCH HISTORY

L7: Entry 1 of 9 File: USPT Apr 16, 2002

US-PAT-NO: 6374293
DOCUMENT-IDENTIFIER: US 6374293 B1

TITLE: Network management system using model-based intelligence

DATE-ISSUED: April 16, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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Emery; Dale H.	Berwick	ME		
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Wiggin; Dwayne S.	Rochester	NH		
Gray; Eric W.	Manchester	NH		
Scott; Walter P.	Salem	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
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APPL-NO: 08/616824 [PALM]
DATE FILED: March 15, 1996

PARENT-CASE:
This application is a continuation division of application Ser. No. 08/243,642, filed on May 16, 1994 now U.S. Pat. No. 5,504,921 entitled NETWORK MANAGEMENT SYSTEM USING MODEL-BASED INTELLIGENCE, which is a continuation application under 37 CFR 1.60 of prior application Ser. No. 07/583,509, filed on Sep. 17, 1990 entitled NETWORK MANAGEMENT SYSTEM USING MODEL-BASED INTELLIGENCE (now abandoned).

INT-CL-ISSUED: [07] G06 F 15/177, G06 F 15/173, G06 F 13/40

US-CL-ISSUED: 709/220; 709/226, 709/249, 709/250, 709/221, 709/332, 709/315, 709/316
US-CL-CURRENT: 709/220; 709/221, 709/226, 709/249, 709/250, 719/315, 719/316, 719/332

FIELD-OF-CLASSIFICATION-SEARCH: 709/1, 709/220, 709/221, 709/225, 709/226, 709/230, 709/238, 709/249, 709/251, 709/252, 709/218, 709/224, 709/229, 709/231, 709/223, 709/232, 709/222, 709/250, 709/332
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL | Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4251858	February 1981	Cambique et al.	395/200 X
☐	4545011	October 1985	Lyon et al.	364/200
☐	4695946	September 1987	Andreasen et al.	395/575
☐	4701845	October 1987	Andreasen et al.	395/575
☐	4821220	April 1989	Duisberg	364/578
☐	4827411	May 1989	Arrowood et al.	364/300
☐	4833592	May 1989	Yamanaka	364/188 X
☐	4858152	August 1989	Estes	364/550
☐	4896319	January 1990	Lidinsky et al.	370/60
☐	4956835	September 1990	Grover	370/16
☐	5008853	April 1991	Bly et al.	364/900
☐	5036334	July 1991	Henderson et al.	342/460
☐	5038318	August 1991	Roseman	395/375
☐	5049873	September 1991	Robins et al.	340/825.06
☐	5133063	July 1992	Naito et al.	395/500
☐	5138712	August 1992	Corbin	395/700
☐	5226120	July 1993	Brown	395/200
☐	5274572	December 1993	O'Neill et al.	702/57
☐	5276789	January 1994	Besaw et al.	395/140

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*Cantone, R. et al., "Model-Based Probabilistic Reasoning For Electronics Troubleshooting," Proc. 8th International Joint Conference on AI, Aug. 8-12, 1983, pp. 207-211.
*Hseush, W. et al., "A Network Architecture for Reliable Distributed Computing", Proc. 1987, Symp. on Simulation of Computer Networks, pp. 11-22.
*Jones, E., et al., "Monitoring and Analysis Strategies For Digital Networks," IEEE J. on Selected Areas in Comm., vol. 6, No. 4, May 1988, pp. 715-721.
*Sutter, M. et al., "Designing Expert Systems for Real-Time Diagnosis of Self-Correcting Networks," IEEE Network Magazine, Sep. 1988, pp. 43-51.
*Gargano et al., "A Logical Data Model On Integrated Geographical Database," IEEE 0/1990, pp. 473-481.
*Rochlin, "An Information Model For Intelligent Network Services," IEEE Jul. 1989, pp. 147-153.
*Steven L. Fulton et al., "An Introduction to Model-Based Reasoning," AI Expert, Jan. 1990, pp. 48-55.
*Rodger Knaus, "A Portable Inference Engine," AI Expert, Jan. 1990, pp. 17-20.
*R.S. Gilbert et al., "CNMGRAF--Graphic Presentation Serv. for Network Management," Proc. 9th Data Comm. Symp., Sep. 10-13, 1985, pp. 199-206.
*D. Bursky, "Simulator Eases Communication Network Design," Electronic Design, vol. 37, No. 21, Oct. 12, 1989, pp. 97-98, 100.

*SynOptics Product Announcement, "Advanced Network Management For Ethernet And Token Ring," Mar. 4, 1991, pp. 1-15.
*Fledkhun, L. et al., "Event Management as a Common Functional Area of Open Systems Management," Integrated Network Management I, Meandzya, B. et al. (Eds.) 1989 pp. 365-376.
*Scott, K., "Taking Care of Business with SNMP," Data Communications, Mar. 21, 1990, pp. 31-41.
*Presuhn, R., "Considering CMIP," Data Communications, Mar. 21, 1990, pp. 55-60.

ART-UNIT: 2183

PRIMARY-EXAMINER: Pan; Daniel H.

ATTY-AGENT-FIRM: Wolf, Greenfield, and Sacks, P.C.

ABSTRACT:

A network management system includes a user interface, a virtual network and a device communication manager. The virtual network includes models which represent network entities and model relations which represent relations between network entities. Each model includes network data relating to a corresponding network entity and one or more inference handlers for processing the network data to provide user information. The system performs a fault isolation technique wherein the fault status of a network device is suppressed when it is determined that the device is not defective. User displays include hierarchical location views and topological views of the network configuration. Network devices are represented on the displays by multifunction icons which permit the user to select additional displays showing detailed information regarding different aspects of the corresponding network device.

29 Claims, 13 Drawing figures

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L7: Entry 1 of 9 File: USPT Apr 16, 2002

DOCUMENT-IDENTIFIER: US 6374293 B1
TITLE: Network management system using model-based intelligence

Application Filing Date (1):
19960315

Brief Summary Text (6):
Network management systems have been utilized in the past in attempts to address such issues. Prior art network management systems typically operated by remote access to and monitoring of information from network devices. The network management system collected large volumes of information which required evaluation by a network administrator. Prior art network management systems place a tremendous burden on the network administrator. He must be a networking expert in order to understand the implications of a change in a network device parameter. The administrator must also understand the topology of each section of the network in order to understand what may have caused the change. In addition, the administrator must sift through reams of information and false alarms in order to determine the cause of a problem.

Brief Summary Text (7):
It is therefore desirable to provide a network management system which can systematize the knowledge of the networking expert such that common problems can be detected, isolated and repaired, either automatically or with the involvement of less skilled personnel. Such a system must have certain characteristics in order to achieve this goal. The system must have a complete and precise representation of the network and the networking technologies involved. It is insufficient to extend prior art network management systems to include connections between devices. A network is much more than the devices and the wires which connect them. The networdk involves the network devices, the network protocols and the software running on the devices. Without consideration of these aspects of the network, a model is incomplete. A system must be flexible and extendable. It must allow not only for the modeling of new devices, but must allow for the modeling of new technologies, media applications and protocol. The system must provide a facility for efficiently encapsulating the expert's knowledge into the system.

Brief Summary Text (16):
The models are implemented as software objects containing both data relating to the corresponding network entity and one or more inference handlers for processing the data. The inference handlers are triggered by predetermined virtual network events such as a change in specified network data in the same model, a change in specified network data in a different model, predefined events or changes in models or model relations. Information pertaining to the condition of a network entity can be obtained from the network entity by polling or can be inferred from data contained in other models. An alarm condition is generated when the network data meets a predetermined criteria. Events, alarms and statistical information from the virtual network are stored in a database and are selectively displayed for the user.

Detailed Description Text (2):
A block diagram of a network management system in accordance with the present invention is shown in FIG. 1. The major components of the network management system

are a user interface 10, a virtual network machine 12, and a device communication manager 14. The user interface 10, which may include a video display screen, keyboard, mouse and printer, provides all interaction with the user. The user interface controls the screen, keyboard, mouse and printer and provides the user with different views of the network that is being managed. The user interface receives network information from the virtual network machine 12. The virtual network machine 12 contains a software representation of the network being managed, including models that represent the devices and other entities associated with the network, and relations between the models. The virtual network machine 12 is associated with a database manager 16 which manages the storage and retrieval of disk-based data. Such data includes configuration data, an event log, statistics, history and current state information. The device communication manager 14 is connected to a network 18 and handles communication between the virtual network machine 12 and network devices. The data received from the network devices is provided by the device communication manager to the virtual network machine 12. The device communication manager 14 converts generic requests from the virtual network machine 12 to the required network management protocol for communicating with each network device. Existing network management protocols include Simple Network Management Protocol (SNMP), Internet Control Message Protocol (ICMP) and many proprietary network management protocols. Certain types of network devices are designed to communicate with a network management system using one of these protocols.

Detailed Description Text (14):
3. Attribute flags indicate how the attribute is to be manipulated. A memory flag indicates that the attribute is stored in memory. A database flag indicates that the attribute is maintained in the database of the virtual network machine. An external flag indicates that the attribute is maintained in the device being modeled. A polled flag indicates that the attributes' value should be periodically surveyed or polled by the device being modeled. The flags also indicate whether the attribute is readable or writable by the user.

Detailed Description Text (22):
It will be understood that communication between a model and its corresponding network entity is possible only for certain types of devices such as bridges, card racks, hubs, etc. In other cases, the network entity being modeled is not capable of communicating its status to the network management system. For example, models of buildings or rooms containing network devices and models of cables cannot communicate with the corresponding network entities. In this case, the status of the network entity is inferred by the model from information contained in models of other network devices. Since successful polling of a network device connected to a cable may indicate that the cable is functioning properly, the status of the cable can be inferred from information contained in a model of the attached network device. Similarly, the operational status of a room can be inferred from the operational status contained in models of the network devices located within the room. In order for a model to make such inferences, it is necessary for the model to obtain information from related models. In a function called a model watch, an attribute in one model is monitored or watched by one or more other models. A change in the watched attribute may trigger inference handlers in the watching models.

Detailed Description Text (23):
The virtual network machine also includes an event log, a statistics log and an alarm log. These logs permit information contained in the models to be organized and presented to the user and to be recorded in the database.

Detailed Description Text (24):
The event message provides specific information about events, including alarms that have occurred in a given model. The events pass from the model to an event log manager which records the event in the external database. An event message is also

sent to the user interface based on event filters, as discussed below. The user can request event information from the database. An event message includes a model handle, a model-type handle, an event date and time, an event type and subtype, an event severity, a model name, a model-type name, an event user name, an event data count and event variable data. The event variable data permits additional information to be provided about the event.

Detailed Description Text (26):
Statistics history messages are similar to the event messages described above. The statistics information includes any model parameters or functions which the user wishes to monitor. A statistics history message passes from the model to a statistics log manager and subsequently to the external database. The statistics message is also sent to the user interface based predefined filter parameters. The user can request the statistics log manager to obtain and display statistics information from the external database. Statistics messages are compiled whenever a device read procedure occurs.

Detailed Description Text (29):
In operation, at a specified time model 144 initiates polling of network device 44 in step 200 in order to obtain an update of the status of network device 44. The model 144 sends a request to the device communication manager 14 to poll network device 44. The device communication manager 14 converts the request to the required protocol for communication with network device 44 and sends the message. The requested information may, for example, be the number of packets sent on the network in a given time and the number of errors that occurred. When the requested information is returned to model 144, the corresponding attributes in model 144 are updated in step 206 and an error rate inference handler is triggered. The error rate inference handler in step 208 calculates the error rate for network device 44. If the error rate is within prescribed limits (step 210), an error rate attribute is updated, and the new information is logged into the database (step 212). If the calculated error rate is above a predetermined limit, an error alarm inference handler is triggered. The error alarm inference handler may shut off the corresponding network device 44 and send an alarm to the user interface in step 214. The alarm is also logged in the database. If the network device 44 is shut off in response to-a high error rate, a condition attribute in model 144 is updated to reflect the off condition in step 216. If no response was received from the network device 44 when it was polled (step 218), a fault isolation inference handler is triggered in step 220. The fault isolation inference handler operates as described below to determine the network component which caused network device 44 to fail to respond to the poll. When the cause of the fault is determined, a fault message is sent to the user interface.

Detailed Description Text (49):
The virtual network machine described above including models and model relations provides a very general approach to network management. By customizing the virtual network machine, virtually any network management function can be implemented. Both data (attributes) and intelligence (inference handlers) are encapsulated into a model of a network entity. New models can be generated by combining or modifying existing models since the models are implemented in the C++ programming language. A model can be identified by a variety of different dimensions or names, depending on the attributes specified. For example, a particular network device can be identified as a device, a type of device, or by vendor or model number. Models are interrelated with each other by different types of relations. The relations permit stimulus-response chaining. The model approach provides loosely-coupled intelligent models with interaction between models according to specified triggers. The system has data location independence. The data for operation of the virtual network machine may reside in the database, memory or in the physical network which is being modeled.

Detailed Description Text (52):

The fault isolation technique is advantageously implemented in the conjunction with the model-based representation of the network and polling of network devices as described above. In a preferred embodiment of the fault isolation technique, each model that is capable of polling its corresponding network device maintains a fault status for that device. If contact with the device is lost, the fault status is set. Each such model also maintains a count of the number of network devices that are directly connected to the network device. In addition, each such model maintains a count of the number of adjacent network devices for which contact has been lost. This information is determined by each model watching the fault status in models corresponding to adjacent network devices. When a given model loses contact with is corresponding network device, two operations are performed. The fault status of the model is set, and the count of total adjacent devices is compared with the count of adjacent devices for which the fault status is set. If the counts are equal, all adjacent models have lost contact with their corresponding network devices. In this case, the fault status of the first model is suppressed.

Detailed Description Text (64):
Examples of topological views are shown in FIGS. BA and 8B. In FIG. 8A, a topological view of a corporate site is shown. An administration network icon 330 and an engineering network icon 332 are interconnected to an Internet icon 334 by links 336. Each network is represented by a multifunction icon. By clicking on the engineering network icon 332, a view of the details of the engineering network is obtained, as shown in FIG. 8B. The network devices in the engineering network are represented by multifunction icons 340, 342, 344, and the interconnections 346 between network devices are shown.

Detailed Description Text (71):
The user interface 10 and the virtual network machine 12 communicate via Unix sockets. Messages between these two components are encoded in a machine independent format. A user interface object such as an icon manager or a view manager may communicate with a model, model type or model relation in the virtual network machine in order to retrieve attribute data.

Other Reference Publication (5):
*Gargano et al., "A Logical Data Model On Integrated Geographical Database," IEEE 0/1990, pp. 473-481.

Previous Doc Next Doc Go to Doc#

L7: Entry 2 of 9 File: USPT Apr 11, 2000

US-PAT-NO: 6049828
DOCUMENT-IDENTIFIER: US 6049828 A

TITLE: Method and apparatus for monitoring the status of non-pollable devices in a computer network

DATE-ISSUED: April 11, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Dev; Roger H.	Durham	NH		
Nelson; Mark H.	Fremont	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Cabletron Systems, Inc.	Rochester	NH			02

APPL-NO: 09/153711 [PALM]
DATE FILED: September 15, 1998

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATION This application is a continuation of application Ser. No. 08/824,492 filed Mar. 27, 1997 (now U.S. Pat. No. 5,812,750) entitled METHOD AND APPARATUS FOR MONITORING THE STATUS OF NON-POLLABLE DEVICES IN A COMPUTER NETWORK, which is a continuation of U.S. Ser. No. 08/623,281 filed Mar. 28, 1996 (abandoned), which is a continuation of U.S. Ser. No. 08/355,430 filed Dec. 13, 1994 (now U.S. Pat. No. 5,559,955), which is a continuation of U.S. Ser. No. 08/216,696 filed Mar. 23, 1994 (abandoned), which is a continuation of U.S. Ser. No. 07/797,121 filed Nov. 22, 1991 (abandoned), which is a continuation-in-part of U.S. Ser. No. 07/583,509 filed Sep. 17, 1990 (abandoned).

INT-CL-ISSUED: [07] G06 F 7/38

US-CL-ISSUED: 709/224; 709/220, 709/223, 709/226, 709/239, 714/11, 714/43, 714/56
US-CL-CURRENT: 709/224; 709/220, 709/223, 709/226, 709/239, 714/11, 714/43, 714/56

FIELD-OF-CLASSIFICATION-SEARCH: 345/969, 709/220, 709/223, 709/224, 709/225, 709/226, 709/229, 709/249, 709/253, 709/239, 714/11, 714/43, 714/56
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4251858	February 1981	Cambigue et al.	395/200 X
☐	4545011	October 1985	Lyon et al.	364/200
☐	4695946	September 1987	Andreasen et al.	395/575
☐	4701845	October 1987	Andreasen et al.	395/575
☐	4827411	May 1989	Arrowood et al.	364/300
☐	4833592	May 1989	Yamanaka	364/188 X
☐	4858152	August 1989	Estes	364/550
☐	4896319	January 1990	Lidinsky et al.	370/60
☐	4956835	September 1990	Grover	370/16
☐	5008853	April 1991	Bly et al.	364/900
☐	5036334	July 1991	Henderson et al.	342/460
☐	5038318	August 1991	Roseman	395/375
☐	5049873	September 1991	Robins et al.	340/825.06
☐	5133063	July 1992	Naito et al.	395/500
☐	5138712	August 1992	Corbin	395/700
☐	5226120	July 1993	Brown	395/200
☐	5276789	January 1994	Besaw et al.	395/140
☐	5559955	September 1996	Dev et al.	395/182.02
☐	5606664	February 1997	Brown et al.	709/1
☐	5802286	September 1998	Dere et al.	709/5

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FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
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WO 80/01615	August 1980	WO	

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Allwood et al., "Diagnosing Faults In A Telecommunications Network By An Expert System," IEEE Proceedings I. Solid-State & Electronic Devices, vol. 137, No. 5, Oct. 1, 1990, pp. 273-280.
T.E.Marques, "A Sympton-Driven Expert System For Isolating And Correcting Network Faults," IEEE Communications Magazine, vol. 26, No. 3, Mar. 1988, pp. 6-13.
J.R. Agre, "A Message-Based Fault Diagnosis Procedure," ACM SIGCOMM '86 Symposium On Communications Architectures And Protocols, Stowe, Vermont USA, Aug. 5-7, 1986, vol. 16, No. 3, ISSN 0146-4833, Computer Communication Review, Aug. 1986, USA, pp. 328-337.
R.S.Gilbert et al., "CNMGraf--Graphic Presentation Services For Network Management," Proceedings of the Ninth Data Communications Symposium (Cat. No. 85CH2137-8), Whistler Mountain, BC, Canada, Sep. 10-13, 1985, ISBN 0-89791-164-4, 1985, Washington DC, USA, IEEE Comput. Soc. Press, USA, pp. 199-206.
D.Bursky,"Simulator Eases Communication Network With Integrated Graphics, A Simulator Helps Designer Create Network Models To Analyze Throughput," Electronic

Design, vol. 37, No. 21, Oct. 12, 1989, pp. 97/98.
Andrew S. Tanenbaum "Structured Computer Organization," Prentice-Hall (1984) pp. 10-12.
Cantone, R. et al., "Model-Based Probabilistic Reasoning For Electronics Troubleshooting," Proc. 8th International Joint Conference on AI, Aug. 8-12, 1983, pp. 207-211.
Hseush, W. et al., "A Network Architecture for Reliable Distributed Computing", Proc. 1987, Symp. on Simulation of Computer Netwoks, pp. 11-12.
Jones, E., et al., "Monitoring and Analysis Strategies For Digital Networks," IEEE J. on Selected Areas in Comm., vol. 6, No. 4, May 1988, pp. 715-721.
Sutter, M. et al., "Designing Expert Systems for Real-Time Diagnosis of Self-Correcting Networks," IEEE Network Magazine, Sep. 1988, pp. 43-51.
Gargano et al., "A Logical Data Model On Integrated Geographical Database," IEEE 0/1990, pp. 473-481.

ART-UNIT: 273

PRIMARY-EXAMINER: Follensbee; John A.

ASSISTANT-EXAMINER: Nguyen; Dzung C

ATTY-AGENT-FIRM: Wolf, Freenfield & Sacks, P.C.

ABSTRACT:

A network management system includes a user interface, a virtual network and a device communication manager. The virtual network includes models which represent network entities and model relations which represent relations between network entities. Each model includes network data relating to a corresponding network entity and one or more inference handlers for processing the network data to provide user information. The system can poll or communicate with certain network entities and can infer the status of network connectors and other network entities for which polling is impossible or impractical. The system performs a fault isolation technique wherein the fault status of a network device is suppressed when it is determined that the device is not defective. User displays include hierarchical location views and topological views of the network configuration. Network devices are represented on the displays by multifunction icons which permit the user to select additional displays showing detailed information regarding different aspects of the corresponding network device.

10 Claims, 16 Drawing figures

L7: Entry 2 of 9 File: USPT Apr 11, 2000

DOCUMENT-IDENTIFIER: US 6049828 A
TITLE: Method and apparatus for monitoring the status of non-pollable devices in a computer network

Application Filing Date (1):
19980915

Brief Summary Text (6):
Network management systems have been utilized in the past in attempts to address such issues. Prior art network management systems typically operated by remote access to and monitoring of information from network devices. The network management system collected large volumes of information which required evaluation by a network administrator. Prior art network management systems place a tremendous burden on the network administrator. He must be a networking expert in order to understand the implications of a change in a network device parameter. The administrator must also understand the topology of each section of the network in order to understand what may have caused the change. In addition, the administrator must sift through reams of information and false alarms in order to determine the cause of a problem.

Brief Summary Text (7):
It is therefore desirable to provide a network management system which can systematize the knowledge of the networking expert such that common problems can be detected, isolated and repaired, either automatically or with the involvement of less skilled personnel. Such a system must have certain characteristics in order to achieve this goal. The system must have a complete and precise representation of the network and the networking technologies involved. It is insufficient to extend prior art network management systems to include connections between devices. A network is much more than the devices and the wires which connect them. The network involves the network devices, the network protocols and the software running on the devices. Without consideration of these aspects of the network, a model is incomplete. A system must be flexible and extendable. It must allow not only for the modeling of new devices, but must allow for the modeling of new technologies, media applications and protocol. The system must provide a facility for efficiently encapsulating the expert's knowledge into the system.

Detailed Description Text (4):
The virtual network machine 12 contains a software representation of the network being managed, including models that represent the devices and other entities associated with the network, and relations between the models. The virtual network machine 12 is associated with a database manager 16 which manages the storage and retrieval of disk-based data. Such data includes configuration data, an event log, statistics, history and current state information.

Detailed Description Text (5):
The device communication manager 14 is connected to a network 18 and handles communication between the virtual network machine 12 and network devices. The data received from the network devices is provided by the device communication manager to the virtual network machine 12. The device communication manager 14 converts generic requests from the virtual network machine 12 to the required network

management protocol for communicating with each network device. Existing network management protocols include Simple Network Management Protocol (SNMP), Internet Control Message Protocol (ICMP) and many proprietary network management protocols. Certain types of network devices are designed to communicate with a network management system using one of these protocols.

Detailed Description Text (18):
(3) Attribute flags indicate how the attribute is to be manipulated. A memory flag indicates that the attribute is stored in memory. A database flag indicates that the attribute is maintained in the database of the virtual network machine. An external flag indicates that the attribute is maintained in the device being modeled. A polled flag indicates that the attributes value should be periodically surveyed or polled by the device being modeled. The flags also indicate whether the attribute is readable or writable by the user.

Detailed Description Text (26):
It will be understood that communication between a model and its corresponding network entity is possible only for certain types of devices such as bridges, card racks, hubs, etc. In other cases, the network entity being modeled is not capable of communicating its status to the network management system. For example, models of buildings or rooms containing network devices and models of cables cannot communicate with the corresponding network entities. In this case, the status of the network entity is inferred by the model from information contained in models of other network devices. Since successful polling of a network device connected to a cable may indicate that the cable is functioning properly, the status of the cable can be inferred from information contained in a model of the attached network device. Similarly, the operational status of a room can be inferred from the operational status contained in models of the network devices located within the room. In order for a model to make such inferences, it is necessary for the model to obtain information from related models. In a function called a model watch, an attribute in one model is monitored or watched by one or more other models. A change in the watched attribute may trigger inference handlers in the watching models.

Detailed Description Text (27):
The virtual network machine also includes an event log, a statistics log and an alarm log. These logs permit information contained in the models to be organized and presented to the user and to be recorded in the database.

Detailed Description Text (28):
The event message provides specific information about events, including alarms that have occurred in a given model. The events pass from the model to an event log manager which records the event in the external database. An event message is also sent to the user interface based on event filters, as discussed below. The user can request event information from the database. An event message includes a model handle, a model-type handle, an event date and time, an event type and subtype, an event severity, a model name, a model-type name, an event user name, an event data count and event variable data. The event variable data permits additional information to be provided about the event.

Detailed Description Text (30):
Statistics history messages are similar to the event messages described above. The statistics information includes any model parameters or functions which the user wishes to monitor. A statistics history message passes from the model to a statistics log manager and subsequently to the external database. The statistics message is also sent to the user interface based upon predefined filter parameters. The user can request the statistics log manager to obtain and display statistics information from the external database. Statistics messages are compiled whenever a device read procedure occurs.

Detailed Description Text (33):
In operation, at a specified time model 144 initiates polling of network device 44 in step 200 in order to obtain an update of the status of network device 44. The model 144 sends a request to the device communication manager 14 to poll network device 44. The device communication manager 14 converts the request to the required protocol for communication with network device 44 and sends the message. The requested information may, for example, be the number of packets sent on the network in a given time and the number of errors that occurred. When the requested information is returned to model 144, the corresponding attributes in model 144 are updated in step 206 and an error rate inference handler is triggered. The error rate inference handler in step 208 calculates the error rate for network device 44. If the error rate is within prescribed limits (step 210), an error rate attribute is updated, and the new information is logged into the database (step 212). If the calculated error rate is above a predetermined limit, an error alarm inference handler is triggered. The error alarm inference handler may shut off the corresponding network device 44 and send an alarm to the user interface in step 214. The alarm is also logged in the database. If the network device 44 is shut off in response to a high error rate, a condition attribute in model 144 is updated to reflect the off condition in step 216. If no response was received from the network device 44 when it was polled (step 218), a fault isolation inference handler is triggered in step 220. The fault isolation inference handler operates as described below to determine the network component which caused network device 44 to fail to respond to the poll. When the cause of the fault is determined, a fault message is sent to the user interface.

Detailed Description Text (53):
The virtual network machine described above including models and model relations provides a very general approach to network management. By customizing the virtual network machine, virtually any network management function can be implemented. Both data (attributes) and intelligence (inference handlers) are encapsulated into a model of a network entity. New models can be generated by combining or modifying existing models since the models are implemented in the C++ programming language. A model can be identified by a variety of different dimensions or names, depending on the attributes specified. For example, a particular network device can be identified as a device, a type of device, or by vendor or model number. Models are interrelated with each other by different types of relations. The relations permit stimulus-response chaining. The model approach provides loosely-coupled intelligent models with interaction between models according to specified triggers. The system has data location independence. The data for operation of the virtual network machine may reside in the database, memory or in the physical network which is being modeled.

Detailed Description Text (56):
The fault isolation technique is advantageously implemented in the conjunction with the model-based representation of the network and polling of network devices as described above. In a preferred embodiment of the fault isolation technique, each model that is capable of polling its corresponding network device maintains a fault status for that device. If contact with the device is lost, the fault status is set. Each such model also maintains a count of the number of network devices that are directly connected to the network device. In addition, each such model maintains a count of the number of adjacent network devices for which contact has been lost. This information is determined by each model watching the fault status in models corresponding to adjacent network devices. When a given model loses contact with its corresponding network device, two operations are performed. First, the fault status of the model is set. Second, the count of total adjacent devices is compared with the count of adjacent devices for which the fault status is set. If the counts are equal, all adjacent models have lost contact with their corresponding network devices, and the fault status of the first model is suppressed.

Detailed Description Text (68):
Examples of topological views are shown in FIGS. 8A and 8B. In FIG. 8A, a topological view of a corporate site is shown. An administration network icon 330 and an engineering network icon 332 are interconnected to an Internet icon 334 by links 336. Each network is represented by a multifunction icon. By clicking on the engineering network icon 332, a view of the details of the engineering network is obtained, as shown in FIG. 8B. The network devices in the engineering network are represented by multifunction icons 340, 342, 344, and the interconnections 346 between network devices are shown.

Detailed Description Text (75):
The user interface 10 and the virtual network machine 12 communicate via Unix sockets. Messages between these two components are encoded in a machine independent format. A user interface object such as an icon manager or a view manager may communicate with a model, model type or model relation in the virtual network machine in order to retrieve attribute data. It is to be understood that alternative embodiments may utilize any of a variety of software communication methods and that the present invention is in no way limited to any particular operating system or any particular software communication protocol.

Detailed Description Text (86):
The connector model classifies ports into two types. First, there are repeater ports. Repeater ports are extremely common entities within a network. For instance, a network hub may have 100 repeater ports. The connector model, however, requires information from only a relatively few of the repeater ports. More specifically, the connector model requires information from only those repeater ports that are connected to a connector with a corresponding inferred connector model. It is therefore advantageous to limit polling requests to those repeater ports that are connected to modeled connectors. In a preferred embodiment, the connector models poll only those repeater ports that are connected to a modeled connector. Second, there are Internet Interface ports, which are far less common than repeater ports in a network system. In the preferred embodiment all Internet Interface ports are polled, as the relative infrequency of these ports does not warrant the extra complexity of optimizing software. It is understood, however, that the same technique applied to repeater port polling optimization can easily be applied to Internet Interface ports.

Detailed Description Text (87):
The Internet Interface port specific routines utilize names that reflect the terms used within the art. Specifically, admin.sub.-- status and operational.sub.-- status are attributes within the Management Information Base (MIB) of Internet Interface ports. The connector models utilize these names. Operational.sub.-- status represents the actual status of the port. Admin.sub.-- status represents the desired status of the port. It should be noted that individual ports can be turned off by the management system. When this is done, admin.sub.-- status is "down"; admin.sub.-- status or operational.sub.-- status of "up" indicates that the port is operative.

Detailed Description Text (95):
6. An INTERFACE.sub.-- INTERNAL.sub.-- LINK.sub.-- STATUS routine determines the port.sub.-- link.sub.-- status for Internet Interface ports that are connected to a modeled connector. This routine polls operational.sub.-- status for those ports. When the operational.sub.-- status is "down" and the admin.sub.-- status is "up" after polling, this routine sets port.sub.-- link.sub.-- status to "bad"; otherwise port.sub.-- link.sub.-- status is set to "good". It should be noted that a port can be turned off by the management system. When this is done, admin.sub.-- status is set to "down." It follows that for connector model purposes, when the desired status, i.e., admin status, is down for a particular port, an operational.sub.-- status of down for that port should not be construed as the port being inoperative. For the reasons discussed above, when contact.sub.-- status is "lost" for the

ported device, port.sub.-- link.sub.-- status is set to "unknown."

Detailed Description Text (99):
The formula makes the following inferences. First, if all entities connected to a connector are either "lost," known "bad," or "initial," the connector is inferred to be "lost." This inference is sound because, if the connector is "lost," this can account for all of the devices having their contact status as "lost" or their port.sub.-- link.sub.-- status as "bad." Second, if all the devices on the connector are still in an initial state, then the connector is best described as being in an initial state, i.e., it is not yet known whether the connector is properly connected. It should be noted that models do not remain in an "initial" state for very long. Contact.sub.-- status changes from "initial." after the next polling interval. Polling intervals ordinarily occur on the order of every minute, but as previously stated the polling interval is programmable. Finally, if any device connected to the connector is "established", then the connector must be established, as there is no other way in which the device could have that contact.sub.-- status.

Other Reference Publication (11):
Gargano et al., "A Logical Data Model On Integrated Geographical Database," IEEE 0/1990, pp. 473-481.

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L7: Entry 3 of 9 File: USPT Sep 22, 1998

US-PAT-NO: 5812750
DOCUMENT-IDENTIFIER: US 5812750 A

TITLE: Method and apparatus for monitoring the status of non-pollable devices in a computer network

DATE-ISSUED: September 22, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Dev; Roger H.	Durham	NH		
Nelson; Mark H.	Fremont	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Cabletron Systems, Inc.	Rochester	NH			02

APPL-NO: 08/824492 [PALM]
DATE FILED: March 27, 1997

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATION This application is a continuation of application Ser. No. 08/623,281, filed Mar. 28, 1996 which is now abandoned, which is a continuation of application Ser. No. 08/355,430, filed Dec. 13, 1994, issued as U.S. Pat. No. 5,559,955, which is a continuation of application Ser. No. 08/216,696, filed Mar. 23, 1994 which was abandoned, which is a continuation of Ser. No. 07/797,121, filed Nov. 22, 1991 which was abandoned, which is a continuation of Ser. No. 07/583,509 filed Sep. 17, 1990, now abandoned.

INT-CL-ISSUED: [06] G06 F 11/34

US-CL-ISSUED: 395/182.02
US-CL-CURRENT: 714/4

FIELD-OF-CLASSIFICATION-SEARCH: 364/DIG.1MSFile, 364/DIG.2MSFile, 395/180, 395/182.02, 395/182.19, 395/183.01, 395/183.06, 395/183.13, 395/200.01, 395/200.02, 395/200.1, 395/200.11, 395/200.3
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

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☐	4545011	October 1985	Lyon et al.	364/200
☐	4694946	September 1987	Andreasen et al.	395/575
☐	4701845	October 1987	Andreasen et al.	395/575
☐	4827411	May 1989	Arrowood et al.	364/300
☐	4833592	May 1989	Yamanaka	364/188 X
☐	4858152	August 1989	Estes	364/550
☐	4896319	January 1990	Lidinsky et al.	370/60
☐	4956835	September 1990	Grover	370/16
☐	5008853	April 1991	Bly et al.j	364/900
☐	5036334	July 1991	Henderson et al.	342/460
☐	5038318	August 1991	Roseman	395/375
☐	5049873	September 1991	Robins et al.	340/825.06
☐	5133063	July 1992	Naito et al.	395/500
☐	5138712	August 1992	Corbin	395/700
☐	5226120	July 1993	Brown	395/200
☐	5276789	January 1994	Besaw et al.	395/140
☐	5559955	September 1996	Der et al.	395/182.02

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ART-UNIT: 274

PRIMARY-EXAMINER: Harrell; Robert B.

ATTY-AGENT-FIRM: Wolf, Greenfield & Sacks, P.C.

ABSTRACT:

A network management system includes a user interface, a virtual network and a device communication manager. The virtual network includes models which represent network entities and model relations which represent relations between network entities. Each model includes network data relating to a corresponding network entity and one or more inference handlers for processing the network data to provide user information. The system can poll or communicate with certain network entities and can infer the status of network connectors and other network entities for which polling is impossible or impractical. The system performs a fault isolation technique wherein the fault status of a network device is suppressed when it is determined that the device is not defective. User displays include hierarchical location views and topological views of the network configuration. Network devices are represented on the displays by multifunction icons which permit the user to select additional displays showing detailed information regarding different aspects of the corresponding network device.

25 Claims, 16 Drawing figures

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L7: Entry 6 of 9 File: USPT Apr 2, 1996

US-PAT-NO: 5504921
DOCUMENT-IDENTIFIER: US 5504921 A
**** See image for Certificate of Correction ****

TITLE: Network management system using model-based intelligence

DATE-ISSUED: April 2, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Dev; Roger H.	Durham	NH		
Emery; Dale H.	Berwick	ME		
Rustici; Eric S.	Londonderry	NH		
Brown; Howard M.	Rochester	NH		
Wiggin; Dwayne S.	Rochester	NH		
Gray; Eric W.	Manchester	NH		
Scott; Walter P.	Salem	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Cabletron Systems, Inc.		DE			02

APPL-NO: 08/243642 [PALM]
DATE FILED: May 16, 1994

PARENT-CASE:
This application is a continuation of application Ser. No. 07/538,509 filed Sep. 17, 1990, now abandoned.

INT-CL-ISSUED: [06] G06 F 11/30, G06 F 11/32

US-CL-ISSUED: 395/800; 395/200.1, 395/200.11, 395/200.2, 395/600, 364/DIG.1
US-CL-CURRENT: 709/223; 707/10, 709/224, 709/242

FIELD-OF-CLASSIFICATION-SEARCH: 395/800, 395/200, 395/161, 395/155, 395/140, 395/200.1, 395/200.11, 395/200.2, 395/600, 364/DIG.1
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

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☐	4956835	September 1990	Grover	370/16
☐	5008853	April 1991	Bly et al.	364/900
☐	5036334	July 1991	Henderson et al.	342/460
☐	5038318	August 1991	Roseman	395/375
☐	5049873	September 1991	Robins et al.	340/825.06
☐	5133063	July 1992	Naito et al.	395/500
☐	5138712	August 1992	Corbin	395/700
☐	5226120	July 1993	Brown et al.	395/200
☐	5276789	January 1994	Besaw et al.	395/140

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D. Bursky, "Simulator Eases Communication Network Design," Electronic Design, vol. 37, No. 21, 12 Oct. 1989, pp. 97-98.
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Presuhn, R., "Considering CMIP", Data Communications, Mar. 21, 1990, pp. 55-60.
Cantone, R. et al., "Model-Based Probabilistic Reasoning For Electronics Troubleshooting," Proc. 8th International Joint Conference On AI, Aug. 8-12, 1983, pp. 207-211.
Hseush, W. et al. "A Network Architecture For Reliable Distributed Computing," Proc. 1987 Symp. On Simulation Of Computer Networks, pp. 11-22.
Jones, E. et al., "Monitoring And Analysis Strategies For Digital Networks," IEEE J. On Selected Areas In Communications, vol. 6, No. 4, May 1988, pp. 715-721.
Sutter, M. et al., "Designing Expert Systems For Real-Time Diagnosis Of Self-Correcting Networks," IEEE Network Magazine, Sep. 1988, pp. 43-51.
"Advanced Network Management For Ethernet And Token Ring," (Product Announcement) SynOptics Communications, Inc., Mar. 4, 1991.

ART-UNIT: 232

PRIMARY-EXAMINER: Bowler; Alyssa H.

ASSISTANT-EXAMINER: Nguyen; Dzung C.

ATTY-AGENT-FIRM: Wolf, Greenfield & Sacks

ABSTRACT:

A network management system includes a user interface, a virtual network and a device communication manager. The virtual network includes models which represent network entities and model relations which represent relations between network entities. Each model includes network data relating to a corresponding network entity and one or more inference handlers for processing the network data to provide user information. The system performs a fault isolation technique wherein the fault status of a network device is suppressed when it is determined that the device is not defective. User displays include hierarchical location views and topological views of the network configuration. Network devices are represented on the displays by multifunction icons which permit the user to select additional displays showing detailed information regarding different aspects of the corresponding network device.

53 Claims, 13 Drawing figures

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L7: Entry 7 of 9 File: USPT Jul 25, 1995

US-PAT-NO: 5436909
DOCUMENT-IDENTIFIER: US 5436909 A

TITLE: Network management system using status suppression to isolate network faults

DATE-ISSUED: July 25, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Dev; Roger H.	Durham	NH		
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Rustici; Eric S.	Londonderry	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Cabletron Systems, Inc.	Rochester	NH			02

APPL-NO: 07/789000 [PALM]
DATE FILED: November 7, 1991

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATION This application is a division of application Ser. No. 07/583,509 filed Sep. 17, 1990, now abandoned.

INT-CL-ISSUED: [06] G06 F 11/30, G01 R 31/08

US-CL-ISSUED: 371/20.1; 371/29.1, 395/916
US-CL-CURRENT: 714/4; 706/916

FIELD-OF-CLASSIFICATION-SEARCH: 371/29.1, 371/20.1, 395/916
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
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4701845	October 1987	Andreasen et al.	395/575

☐	4827411	May 1989	Arrowood et al.	364/300
☐	4833592	May 1989	Yamanaka	364/188 X
☐	4858152	August 1989	Estes	395/161 X
☐	5008853	April 1991	Bly et al.	364/900
☐	5038318	August 1991	Roseman	395/375
☐	5049873	September 1991	Robins et al.	340/825.06
☐	5226120	July 1993	Brown et al.	395/200

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Hseush, W. et al., "A Network Architecture for Reliable Distributed Computing", Proc. 1987 Symp. on Simulation of Computer Networks, pp. 11-22.
Jones, E. et al., "Monitoring and Analysis Strategies for Digital Networks", IEEE J. on Selected Areas in Communications, vol. 6, No. 4, May 1988, pp. 715-721.
Sutter, M. et al., "Designing Expert Systems for Real-Time Diagnosis of Self-Correcting Networks", IEEE Network Magazine, Sep. 1988, pp. 43-51.
Feldkhun, L. et al., "Event Management as a Common Functional Area of Open Systems Management", Integrated Network Management, I, Meandzija, B. et al. (Eds.) 1989, pp. 365-376.
Scott, K., "Taking Care of Business with SNMP", Data Communications, Mar. 21, 1990, pp. 31-41.
Presuhn, R., "Considering CMIP", Data Communications, Mar. 21, 1990, pp. 55-60.
Steven L. Fulton et al, "An Introduction to Model-Based Reasoning", AI Expert, Jan. 1990, pp. 48-55.
Rodger Knaus, "A Portable Inference Engine", AI Expert, Jan. 1990, pp.17-20.
R. S. Gilbert et al, "CNMGRAF--Graphic Presentation Serv. for Network Mgt.", Proc. 9th Data Comm. Symp., 10-13 Sep. 1985, pp. 199-206.
D. Bursky, "Simulator Eases Communication Network Design", Electronic Design, vol. 37, No. 21, 12 Oct. 1989, pp. 97-98, 100.

ART-UNIT: 236

PRIMARY-EXAMINER: Baker; Stephen M.

ATTY-AGENT-FIRM: Wolf, Greenfield & Sacks

ABSTRACT:

A network management system includes a user interface, a virtual network and a device communication manager. The virtual network includes models which represent network entities and model relations which represent relations between network entities. Each model includes network data relating to a corresponding network entity and one or more inference handlers for processing the network data to provide user information. The system performs a fault isolation technique wherein the fault status of a network device is suppressed when it is determined that the device is not defective. User displays include hierarchical location views and topological views of the network configuration. Network devices are represented on the displays by multifunction icons which permit the user to select additional displays showing detailed information regarding different aspects of the corresponding network device.

5 Claims, 13 Drawing figures

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L7: Entry 8 of 9 File: USPT Mar 15, 1994

US-PAT-NO: 5295244
DOCUMENT-IDENTIFIER: US 5295244 A
**** See image for Certificate of Correction ****

TITLE: Network management system using interconnected hierarchies to represent different network dimensions in multiple display views

DATE-ISSUED: March 15, 1994

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Dev; Roger H.	Durham	NH		
Emery; Dale H.	Berwick	ME		
Rustici; Eric S.	Londonderry	NH		
Scott; Walter P.	Salem	NH		
Wiggin; Dwayne S.	Rochester	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Cabletron Systems, Inc.	Rochester	NH			02

APPL-NO: 08/101777 [PALM]
DATE FILED: August 3, 1993

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATION This application is continuation of application Ser. No. 07/790,408 filed Nov. 7, 1991, now abandoned, which is a division of application Ser. No. 07/583,509 filed Sep. 17, 1990.

INT-CL-ISSUED: [05] G06F 15/20, G06F 3/14

US-CL-ISSUED: 395/161; 395/160, 395/159, 395/200
US-CL-CURRENT: 715/853; 709/223, 715/775, 715/839, 715/854, 715/855, 715/969, 715/970

FIELD-OF-CLASSIFICATION-SEARCH: 395/161, 395/160, 395/159, 395/2MS, 364/188, 340/825.06, 340/825.15, 340/825.17
See application file for complete search history.

PRIOR-ART-DISCLOSED:

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☐	4545011	October 1985	Lyon et al.	395/200
☐	4695946	September 1987	Andreasen et al.	395/575
☐	4701845	October 1987	Andreasen et al.	395/575
☐	4827411	May 1989	Arrowood et al.	395/600
☐	4833592	May 1989	Yamanaka	364/188 X
☐	4858152	August 1989	Estes	395/161 X
☐	4896319	January 1990	Lidinsky et al.	370/60
☐	4956835	September 1990	Grover	370/16
☐	5008853	April 1991	Bly et al.	364/900
☐	5036334	July 1991	Henderson et al.	342/460
☐	5038318	August 1991	Roseman	395/375
☐	5049873	September 1991	Robins et al.	340/825.06
☐	5133063	July 1992	Naito et al.	395/500
☐	5138712	August 1992	Corbin	395/700
☐	5226120	July 1993	Brown et al.	395/200

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ART-UNIT: 231

PRIMARY-EXAMINER: Bayerl; Raymond J.

ATTY-AGENT-FIRM: Wolf, Greenfield & Sacks

ABSTRACT:

A network management system includes a user interface, a virtual network and a device communication manager. The virtual network includes models which represent network entities and model relations which represent relations between network entities. Each model includes network data relating to a corresponding network entity and one or more inference handlers for processing the network data to provide user information. The system performs a fault isolation technique wherein the fault status of a network device is suppressed when it is determined that the device is not defective. User displays include hierarchical location views and topological views of the network configuration. Network devices are represented on the displays by multifunction icons which permit the user to select additional displays showing detailed information regarding different aspects of the corresponding network device.

14 Claims, 13 Drawing figures

Previous Doc Next Doc Go to Doc#

L7: Entry 9 of 9 File: USPT Nov 9, 1993

US-PAT-NO: 5261044
DOCUMENT-IDENTIFIER: US 5261044 A
**** See image for Certificate of Correction ****

TITLE: Network management system using multifunction icons for information display

DATE-ISSUED: November 9, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Dev; Roger H.	Durham	NH		
Gray; Eric W.	Manchester	NH		
Rustici; Eric S.	Londonderry	NH		
Scott; Walter P.	Salem	NH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Cabletron Systems, Inc.	Rochester	NH			02

APPL-NO: 07/788936 [PALM]
DATE FILED: November 7, 1991

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATION This application is a division of application Ser. No. 07/583,509 filed Sep. 17, 1990.

INT-CL-ISSUED: [05] G06F 15/62

US-CL-ISSUED: 395/159
US-CL-CURRENT: 715/855; 709/223, 715/775, 715/808, 715/839, 715/969

FIELD-OF-CLASSIFICATION-SEARCH: 395/155-161
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4251858	February 1981	Cambique et al.	395/200 X

☐	4545011	October 1985	Lyon et al.	364/200
☐	4695946	September 1987	Andreasen et al.	395/575
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☐	4858152	August 1989	Estes	364/521
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☐	5038318	August 1991	Roseman	395/375
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Hseush, W. et al, "A Network Arch. for Reliable Dist. Comp.", Proc. 1987, Symp. on Simulation of Computer Networks, pp. 11-22.
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ART-UNIT: 231

PRIMARY-EXAMINER: Herndon; Heather R.

ATTY-AGENT-FIRM: Wolf, Greenfield & Sacks

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23 Claims, 13 Drawing figures